

**AN ANALYSIS OF THE MOON'S SURFACE USING REFLECTED
ILLUMINATION FROM THE EARTH DURING A WANING
CRESCENT LUNAR PHASE**

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ABSTRACT

There have been many articles written concerning the lunar after-glow, the spectacular reflection from the moon's surface, and the possible observation of luminescence on the dark side of the moon. The researcher, using a 600 mm cassegrain telescope lens and Kodak 400 ASA T-Max film, photographed the crescent moon whose dark side was clearly visible by the reflected light from the earth. The film was digitized to a Perkin-Elmer 1010M microdensitometer for enhancement and enlargement. The resulting pictures indicate a completely different land pattern formation than observed during a full moon. There is an attempt to analyze the observed structures and to compare them to the pictures observed during the normal full moon. There are boundaries on the digitized dark section of the moon that can be identified with structures seen during the normal full moon. But, these variations do change considerably under enhancement.

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Introduction

There have been many articles written about the lunar afterglow, the spectacular reflection from the moon's surface and the possible observation of luminescence on the dark side of the moon. Using a 600 mm Cassegrain telescope lens and Kodak 400-ASA T-Max film, we have photographed the crescent moon, whose dark side was clearly visible by the reflected light from the earth. The film was then digitized to a Perkin-Elmer 1010-M microdensitometer for enhancement and enlargement.

Method

We began with an actual negative taken with a 600 mm Cassegrain telescopic lens. The resulting image was then digitized using the microdensitometer. This project of photographing the major luminary next to the sun has given us an opportunity to test both hard and software in digitizing photographic films (Figure I).

Figure I.



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BLACK AND WHITE PHOTOGRAPH

Results

After digitizing using the microdensitometer, an outline of cratering was produced along with the flat plain areas. The light part represents the flat plains, with minimal cratering (Figure II).

Figure II.

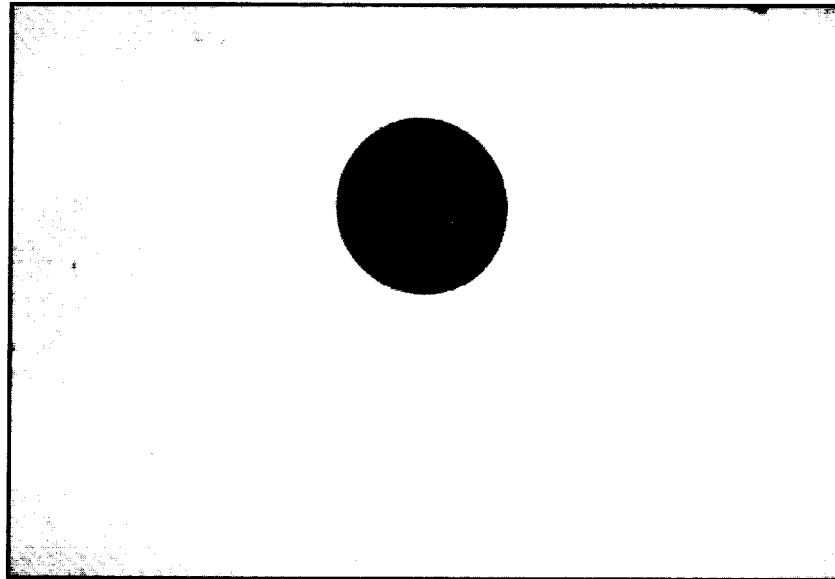
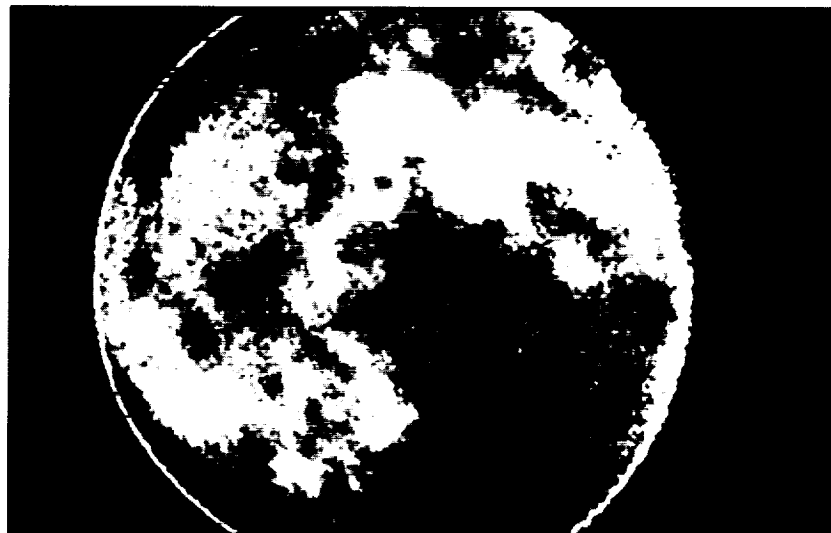


Figure III represents pseudo or false coloring of the moon. Every color represents a different gray level value. One should note, in particular, that the limb around the moon seems to be brighter than most of the interior. It is also noteworthy, that with pseudo coloring, there are structures within the maras or seas that are invisible in the black and white enhanced views (Figure III).

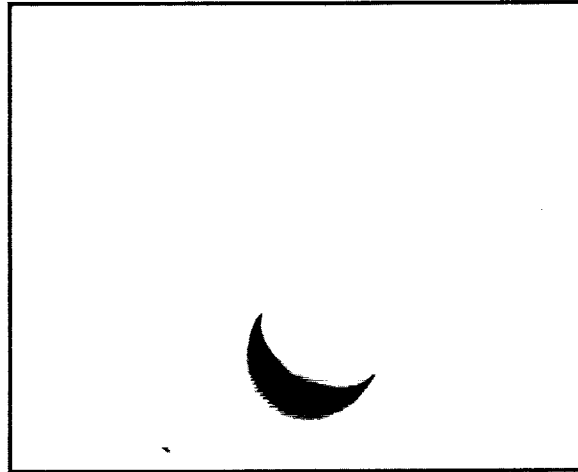
Figure III.



Changing the pseudo color pixel values again will produce dramatic changes within the so-called "lunar seas". Given value determination, we suspect that all blue or red values can tell us something about the mineral content of the surface, if we could know the reflectivity of certain minerals.

Photographs of some of the lunar rocks that the astronauts brought back from the moon, should help identify mineral contents on various parts of the moon (Figure IV).

Figure IV.



Further study of this technique, with an appropriate telescopic instrument, will permit us to review the moon's surface in a way that would be very beneficial and enlightening, and would provide a substantial amount of information about the local cratering areas (Figure V).

Figure V.

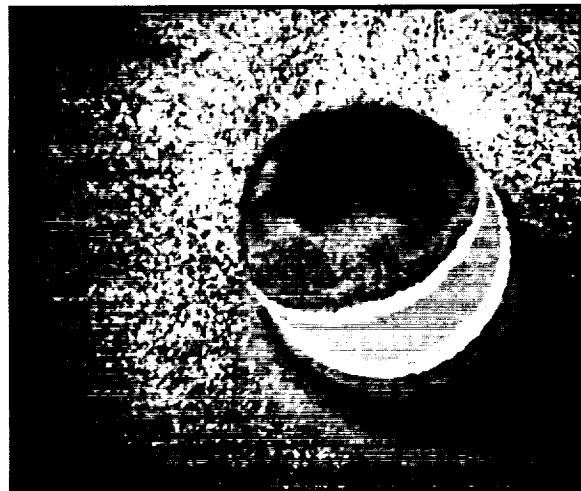
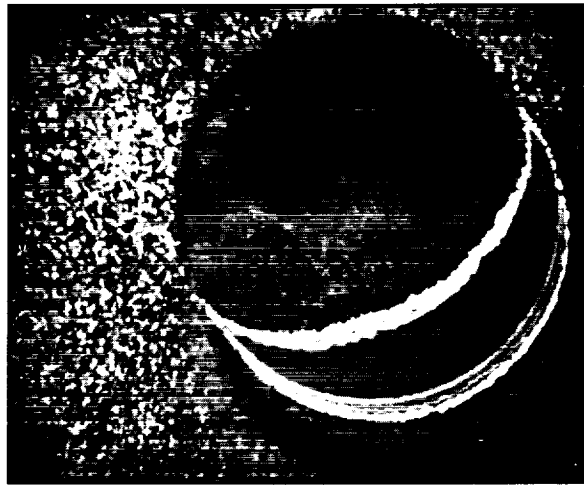


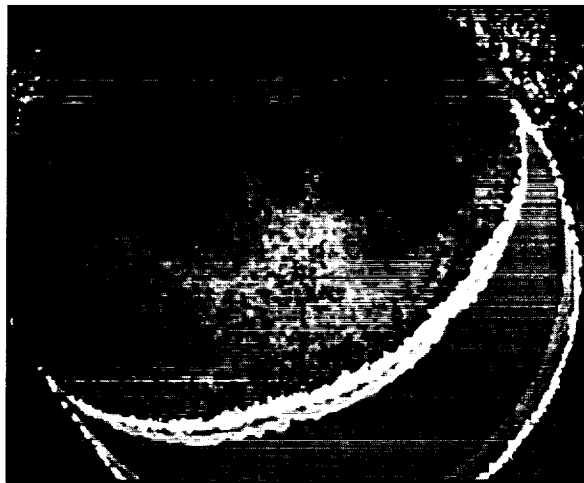
Figure VI represents the zoom capability of looking at the center of the moon, representing an area of 20-square miles. The dark areas represent craters and the flat areas represent plains (Figure VI).

Figure VI.



When one applies false color to this magnified view of the surface, one can clearly see cratering and other structures associated with the same values, along with even greater changes within the interface between the plain and cratering area. The resolution is bad primarily due to the grain size of the film (Figure VII).

Figure VII.



Looking at the moon illuminated by earth shine, the dark area represents the reflected light from the sun and the grayish area represents the reflected light from the earth. Let us consider the enhancement on the slide as the earth's reflected light illuminating the moon (Figure VIII).

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BLACK AND WHITE PHOTOGRAPH

Figure VIII.



A computer zoom of the interface between the waning crescent and the dark side of the moon produces the image seen in Figure IX. One can see cratering, as well as a glow along the limb of the moon. The craters appear as small blobs along the interface between the sunlit part of the moon during this waning crescent.

Figure IX.

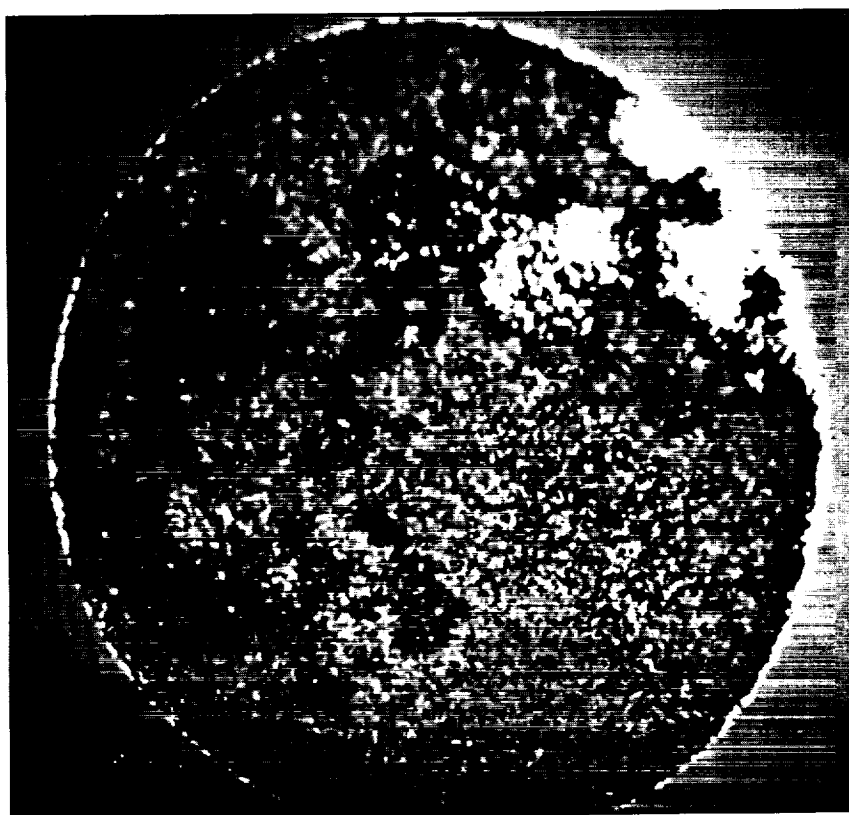
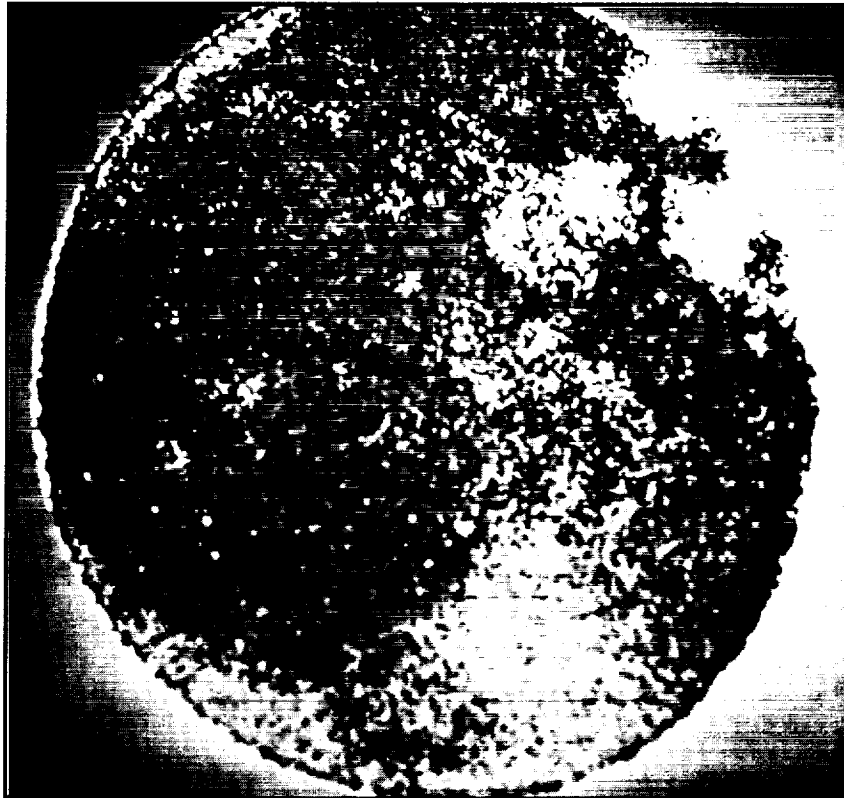


Figure X is a view of the entire moon with its dark side partially illuminated by the light reflected off the earth's surface and atmosphere. Note that the pattern observed is considerably different from those patterns observed when the full disk of the moon was shown. Notice also the ridges and lines that run throughout the surface of the moon, which the eye perceives very differently than when the moon is full (Figure X).

Figure X.



By using false color, one can clearly show patterns and structures which are not seen during the full moon. Also, lens problems within the Cassegrain lens give us some optical flaring effects. However, one of the more interesting aspects is that we can use this technique of pseudo coloring to show lines equal in light intensity.

Conclusion

Careful evaluation of the slides reveals cratering from the same value of the moon. Increased intensity of light on the surface opposite the sun is also noted at the upper limb of the moon. But even more important, the entire pattern on the dark side of the moon is totally different from the pattern observed when the moon is full. We want to continue to explore the pattern differentials, to see if there is any potential to identify mineral content based on the reflected light from the earth and sun.